Energy Policy ▮ (▮▮▮▮) ▮▮▮–▮▮▮

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Utility payments in Ukraine: Affordability, subsidies and arrears

Samuel Fankhauser [a], Yulia Rodionova [b,*], Elisabetta Falcetti [c]

[a] London School of Economics, London, UK
[b] School of Slavonic and East European Studies, University College London, 16 Taviton street, London WC1H 0BW, UK
[c] European Bank for Reconstruction and Development (EBRD), London, UK

ARTICLE INFO

Article history:
Received 15 March 2008
Accepted 25 June 2008

Keywords:
Affordability
Energy
Ukraine

ABSTRACT

The transition from a planned economy to a market economy has caused considerable hardship for the people of Eastern Europe. One important aspect of the social costs of transition is access to, and the affordability of, basic services like electricity, heat and water, which under communism had been supplied fairly cheaply and abundantly. This paper provides evidence on this issue from the Ukraine Longitudinal Monitoring Survey (ULMS). The paper identifies considerable differences in both access and affordability between different localities in Ukraine.

Social protection measures can help to alleviate affordability constraints, but the analysis finds that social support is not well targeted. The currently low tariffs prevent an escalation of affordability problems but constraints nevertheless exist. Many households have accumulated substantial arrears as a consequence, although non-payment is a complex issue and not solely a function of affordability.

1. Introduction

Transition from central planning to a market economy has required deep structural changes in the way the economies, and indeed the societies, of Eastern Europe are organised. This structural change has not been without side-effects and the social costs of transition have in many cases been high. Ukraine is no exception. In a sign of increasing poverty, many people face difficulties in accessing and paying for basic services like electricity, heat and water, which in turn impacts non-monetary dimensions of poverty since "access to (good quality) utility service is often significantly correlated with improved nutrition, sanitation, lower child and infant mortality, and so on" (Foster et al., 2005).

A small but growing literature has emerged that studies energy and water poverty in the transition region as part of a wider concern about the social impact of transition (see, for example, Dodonov et al., 2004; Fankhauser and Tepic, 2007; IPA, 2003; Kennedy, 2005; Lampietti et al., 2001; Lampietti and Meyer, 2002; Lovei et al., 2000; Velody et al., 2003). Several broad conclusions can be drawn from this literature.

The first conclusion is that energy and water poverty in transition countries is primarily a question of affordability, rather than access. Transition countries have inherited from communism relatively well-developed water, heat and electricity systems. In Ukraine, for instance, access to electricity is almost universal. The challenge is to maintain the high connection rates and ensure access remains affordable.

A second conclusion is that affordability problems will probably get worse over the coming years. Affordability constraints have been masked so far by unrealistically low energy and water prices (and, in some cases, poor payment discipline). Tariffs will have to go up substantially to make the underfunded networks financially viable again and finance the extensive rehabilitation needs (see also OECD, 2003, 2005).

A third conclusion is that the social safety provisions to protect low-income consumer from further price increases are insufficient. Social safety nets, where they exist, are often underfunded, poorly managed and inefficient in reaching the target population. While weak institutions are the main reason for these shortcomings, another important factor is poor information about consumption patterns, access and affordability at the level of individual households.

This paper looks at utility payments, access and affordability in Ukraine. Unlike other studies, the paper does not forecast affordability rates or prescribe particular social safety arrangements. Its purpose is purely descriptive. The aim is to paint as detailed picture as possible about energy and water poverty at the household level, including the level of access, the size of the utility bill, the role of social safety measures and the effect of non-payment. A particular focus is on differences between administrative districts, or oblasts.

In doing so the paper draws on two rounds of the Ukrainian Longitudinal Monitoring Survey (ULMS). The ULMS includes both household- and individual-level questions on income and

* Corresponding author.
E-mail address: y.rodionova@ssees.ucl.ac.uk (Y. Rodionova).

0301-4215/$ - see front matter © 2008 Elsevier Ltd. All rights reserved.
doi:10.1016/j.enpol.2008.06.031

expenditure, employment states, access to and payment for services, residence ownership, health, education, town size and region. The first round of the survey took place in 2003 and includes retrospective questions for 1986, 1991, 1997–2003. The second round was conducted in 2004 and includes retrospective questions for 2003.

The survey includes 7201 individuals from around 3500 households. There is also a panel component to the retrospective questions, ranging from 1000 to 4000 respondents for different questions. However, the panel subset of the data from 1986 to 2004 is strongly biased with respect to age (and, as a consequence, a number of other characteristics such as education). Therefore, we use mostly the consecutive years (to analyse the dynamics, as in case of utility arrears) or the cross-section data for 2004. The survey provides sample weights, which are taken into account to ensure the analysis is representative at the individual level.

One of the shortcomings of the survey for the purposes of computing affordability is that it collects information on the average monthly utility payments only once a year. As a result, we are not able to trace the changes in utility payments between seasons, which could bias our estimates of affordability and arrears.

The structure of the paper is as follows. The next section provides a description of access rates and the availability of targeted support in different regions and for different types of households. It tries to identify regional patterns in access rates. Section 3 looks at the affordability of services and calculates affordability ratios—defined as the share of utility expenditures in total household expenditures. The section distinguishes between gross affordability, affordability net of government support and affordability net of arrears. Section 4 takes a closer look at utility arrears and asks to what extent a lenient approach to billing and collection has become a substitute for targeted support. Section 5 concludes. A map of Ukrainian regions is presented in Appendix A.

2. Access

In comparison with other middle income countries, the rate of access to utility services in Ukraine is relatively high, although the quality of service has deteriorated markedly during transition. There are also important differences between different types of services.

Table 1 provides summary statistics on the access rates to various utilities by region. Access is highest for electric power, where there is an almost 100 per cent connection rate in most regions. Access to centralised gas and cold water is highest (average access rate for both is 68 per cent), followed by central heating (56 per cent), sewerage (50 per cent) and hot water (34 per cent).

Not unexpectedly, Kiev,[1] the capital city, has the highest connection rates. The heavily industrialised regions of Eastern and Central Ukraine—areas such as Harkov, Poltava, Dnepropetrovsk, Donetsk and Zaporozhye—with their relatively rich and largely urban population also have high connection rates for most utilities.

Lvov, a major political and cultural centre in Western Ukraine, which is also fairly well off, has high connection rates despite being a predominantly rural oblast. In contrast, poorer agricultural areas in Western Ukraine such as Ivano-Frankovskaya and Zakarpatskaya oblasts tend to have low connection rates (centralised gas is an exception in Ivano-Frankovskaya).

One striking exception is Ternopol oblast, which was the largest agricultural producer in the Soviet era. The oblast has only a small urban population and is currently one of the poorest regions in Ukraine, but it has connection rates comparable to those in Dnepropetrovsk oblast.

To better understand the pattern of access rates, we turn to econometric analysis. Estimation equations for the access rates to the different types of services are treated as a system of seemingly unrelated regressions (SUR)[2] since it is reasonable to assume that the same unobservables (such as macroeconomic shocks or changes in regulation) may affect access to all types of utilities. The explanatory variables included household expenditure (a common proxy for household income), settlement type (e.g. village or small town), ownership of the dwelling, receipt of social support, as well as regional dummies to capture differences between administrative districts.

Access to some services is highly and significantly correlated. The coefficient of correlation between access to centralised gas and central heating, for instance, is 0.55. Similarly, between sewerage and cold water the correlation is 0.59, and between hot water and centralised heat it is 0.51. As a result, some services had to be excluded from the system. The two equations being estimated simultaneously are access to centralised gas and access to sewerage. The SUR estimation method is used because there may be common shocks affecting both types of utilities. Expenditure per capita (with a square term), housing (utility) subsidy, existence of utility arrears, region, settlement type and household size are used as independent variables.

It could be argued that the receipt of a housing subsidy is endogenous to the equation, as it would, among other things, depend on whether a household is connected to utilities. The same argument could be put forward for the existence of utility arrears. This would lead to inconsistent and inefficient estimates. As a possible solution, an attempt is made to instrument both variables, using household size, wage arrears and type of dwelling as instrumental variables for utility arrears, and dirty fuel and transportation subsidies as IVs for the housing subsidy. Utility arrears would be expected to be positively correlated with wage arrears, and also positively correlated with the dwelling being a flat in an apartment building rather than a separate house as it would be more difficult to disconnect a flat in case of severe non-payment. As for the housing subsidy, people who receive it are more likely to get dirty fuel subsidy as well, for a number of reasons. First, the transaction and waiting costs of receiving a housing subsidy would be lower as these individuals would be better informed about the application procedure; second, it could reflect self-selection, people with lower cost of time applying for all subsidies; third, this could be a proxy for local authorities' attitude towards giving subsidies. If the household receives a transportation subsidy, it is less likely to be connected to a number of utilities and receive a housing subsidy.

It would also be interesting to find out how the accumulation (or repayment) of utility arrears affects access rates. The same two equations are next estimated by SUR,[3] including the change in arrears between 2003 and 2004 as an independent variable. This

[1] ULMS uses both Russian and Ukrainian as survey languages. In the paper, region names are presented in Russian, while in the map in the Appendix, they are given in Ukrainian.

[2] SUR estimates are "generally asymptotically more efficient than OLS" estimation equation by equation (Wooldridge, 2002); when all independent variables are the same in both equations, as is in our case, SUR (FGLS) and OLS equation by equation estimation are identical (Wooldridge, 2002, Theorem 7.6, p. 164), but SUR may still be preferable as it allows for testing of joint significance of coefficients across equations.

[3] The correlation between residuals in the two equations is 0.23, and the null hypothesis of uncorrelated residuals in the Breusch–Pagan test is rejected with 99% confidence probability.

Please cite this article as: Fankhauser, S., et al., Utility payments in Ukraine: Affordability, subsidies and arrears. Energy Policy (2008), doi:10.1016/j.enpol.2008.06.031

Table 1
Connection rates to different utilities by region, 2004

Region		Access to the utility, per cent (weighted)						
		Centralised gas supply	Electricity	Sewerage or indoor toilet	Cold water	Hot water	Central heating	Gas/electrical stove
C	Cherkasskaya	36.9	100.0	28.0	38.9	30.3	27.0	93.7
C	Chernigovskaya	64.5	96.2	25.1	75.1	22.1	32.4	59.1
CE	Dnepropetrovskaya	87.7	99.4	52.4	78.6	38.6	78.9	92.8
C	Kiev city	**98.4**	**100.0**	**99.7**	**100.0**	**98.3**	**99.6**	**99.4**
C	Kievskaya	94.4	100.0	56.3	73.3	39.7	80.9	98.9
C	Kirovogradskaya	28.1	100.0	21.5	39.1	6.0	34.8	93.0
C	Vinnickaya	39.2	98.7	35.4	42.6	12.7	42.5	95.5
CE	Zaporozhskaya	56.5	99.7	58.1	87.2	55.9	56.3	97.2
CW	Zhitomirskaya	58.1	89.5	52.9	50.5	54.5	55.3	69.8
E	Doneckaya	48.7	98.7	43.5	80.3	22.0	43.9	64.8
E	Harkovskaya	77.8	99.7	56.8	66.8	41.6	80.4	91.6
E	Luganskaya	43.9	99.3	47.6	71.4	11.1	34.4	79.1
E	Poltavskaya	86.3	100.0	37.4	47.7	20.8	68.2	66.0
E	Sumskaya	59.8	100.0	22.7	34.1	15.7	22.0	42.0
S	Crimea	65.9	100.0	58.1	87.3	19.6	36.9	98.1
S	Hersonskaya	68.7	99.2	59.4	82.5	37.3	55.5	93.7
S	Nikolaevskaya	98.5	100.0	90.9	100.0	55.7	98.5	100.0
S	Odesskaya	56.8	98.4	51.3	80.6	31.1	45.1	86.4
W	Chernovickaya	82.1	96.2	33.0	25.8	0.0	72.1	86.4
W	Hmelnickaya	73.6	100.0	50.4	62.3	34.8	66.2	63.4
W	Ivano-frankovskaya	86.8	100.0	23.6	28.7	20.6	29.7	95.9
W	Lvovskaya	99.9	100.0	57.8	64.1	28.6	59.8	93.5
W	Rovenskaya	72.2	100.0	67.6	71.2	68.2	70.5	99.7
W	Ternopolskaya	88.7	98.7	43.3	75.4	39.3	77.9	96.0
W	Volynskaya	47.8	100.0	51.7	59.3	40.1	64.1	97.7
W	Zakarpatskaya	49.6	90.6	17.0	30.9	7.1	29.0	50.9
	Mean	67.5	98.9	49.8	68.0	33.6	55.8	84.8
	Std. dev.	20.9	2.7	19.9	22.0	21.6	22.3	17.0

reduces the sample size since we have fewer observations on the actual amount of arrears.

The results of the regression analysis are presented in Tables 2–4. Table 2 indicates that connection rates are positively correlated with utility subsidies (the receipt of which increases connection to centralised gas by 12 per cent and to sewerage by 7 per cent) and with the size of the settlement. Town-type settlements and small towns do not differ from villages in terms of having low connection rates, while medium and large towns have proportionally higher access rates. Ownership of a dwelling increases the probability of being connected. Access rates are also positively related to expenditure, although with a decreasing marginal effect. A 10 per cent (UAH 467.3) increase in the per capita expenditure from its mean of UAH 4673 would increase connection rates to the centralised gas by around 0.5 per cent,[4] and to sewerage—by around 0.9 per cent. Accumulation of arrears is negatively associated with connection rates to both utilities.

The alternative specification with instrumental variables gives similar results. However, we have to be cautious when interpreting them, as tests for overidentifying restrictions give a mixed impression of the validity of our instruments. In particular, when looking at the first stage of the estimation, the Anderson–Rubin test shows that the instruments are jointly significant. Anderson canonical correlations likelihood ratio test indicates at 99 per cent that the model is identified, but Hansen *J*-statistic for the validity of instruments does not fare as well.[5]

Regional effects mostly mirror access rates statistics described above, with Kiev having the highest rates and major industrial areas dominating in terms of access.

Regions can be divided into four groups according to how they differ from Kiev city in terms of connection to centralised gas, after controlling for a set of household- and town-specific parameters (Table 3).

The first group consists of Lvov, Crimea and Ternopol regions, which have relatively high access rates. Lvov is a major transport and industrial centre of the Western Ukraine. Ternopol oblast is an important agricultural centre. The second group of regions does not exhibit statistically significant differences from Kiev city in terms of access rates. Two of them—Nikolaev and Poltava—are major industrial centres. The third group has lower access rates than Kiev city, but not dramatically so. This group consists primarily of large industrial and transport centres in the Eastern and Southern parts, such as Dnepropetrovskaya, Harkovskaya, Hersonskaya and Crimea oblasts.

The last group of regions contains mostly economically underdeveloped regions (Sumskaya, Kirovogradskaya and Luganskaya oblasts), as well as regions severely affected by the Chernobyl disaster (Volynskaya oblast). There connection rates are much lower than those in the capital city. Interestingly, Donetskaya oblast, which is highly industrialised and relatively prosperous, also falls into this category.

Table 4 presents marginal effects on the regional dummies from the access to sewerage regression. As can be seen, all regions are significantly below Kiev city (which has almost universal access) in terms of connection rates in this respect, controlling for socio-economic characteristics.

The areas with access rates drastically below those in Kiev are mostly poor and less economically developed regions in the Central and Eastern Ukraine, such as Luganskaya, Kirovogradskaya, Sumskaya, Cherkasskaya oblasts, as well as Chernigovskaya and Ivano-frankovskaya oblasts in the West. On the other hand, this list also contains the relatively well-off industrialised regions like Harkovskaya, Doneckaya and especially

[4] This is computed as $0.4673 \times (0.01) - 0.00003 \times (0.4673 \times 0.4673) = 0.004673 - 0.00000655 = 0.00466$.

[5] The null hypothesis of the instruments being uncorrelated with the error is rejected at conventional levels.

Please cite this article as: Fankhauser, S., et al., Utility payments in Ukraine: Affordability, subsidies and arrears. Energy Policy (2008), doi:10.1016/j.enpol.2008.06.031

Table 2
Marginal effects and coefficients from the access rates regressions

	Access to centralised gas			Access to sewerage		
	Bivariate probit	TSLS	Bivariate probit	Bivariate probit	TSLS	Bivar. Probit
Subsidy (yes/no)	**0.13**	0.12	0.06	**0.07**	0.39	**−0.13**
Owner*	**0.14**	**0.18**	**0.13**	n/a	n/a	n/a
Owner_house	**−0.01**	−0.06	−0.01	n/a	n/a	n/a
Expenditure per capita per 1000UAH	**0.01**	**0.02**	**0.02**	**0.02**	**0.04**	**0.03**
Exp. p/c squared, Per 1000 UAH squared	**−0.03E(−3)**	**−0.03E(−3)**	**−0.01E(−3)**	**−0.01E(−3)**	**−0.01E(−3)**	**−0.01E(−3)**
Town type Settlement	**0.05**	−0.02	−0.04	**0.23**	−0.09	**0.25**
Small town	**0.12**	0.07	**−0.32**	**0.23**	−0.04	**0.32**
Medium town	**0.23**	**0.13**	**0.17**	**0.37**	0.02	**0.55**
Large town	**0.31**	**0.18**	**0.25**	**0.53**	−0.05	**0.60**
Capital city	**0.33**	**0.20**	**0.09**	**0.60**	0.05	**0.65**
Change in arrears	**n/a**	**n/a**	**−0.002**	**n/a**	n/a	**−0.001**

Note: Coefficients in bold are significant at least at 10 per cent.

Table 3
Marginal effects from access to centralised gas regression, 2004

Macroregion	Region	Marginal effects
W	Lvovskaya	**0.27**
C	Kievskaya	**0.19**
W	Ternopolskaya	**0.13**
S	Nikolaevskaya	0.03
W	Ivano-frankovskaya	0.03
E	Poltavskaya	0.01
W	Chernovickaya	−0.03
W	*Zakarpatskaya*	***−0.11***
CE	*Dnepropetrovskaya*	***−0.19***
S	*Hersonskaya*	***−0.20***
C	*Chernigovskaya*	***−0.23***
W	*Hmelnickaya*	***−0.24***
CW	*Zhitomirskaya*	***−0.24***
E	*Harkovskaya*	***−0.26***
S	*Crimea*	***−0.28***
W	*Rovenskaya*	***−0.29***
S	*Odesskaya*	***−0.38***
E	*Sumskaya*	***−0.38***
W	Volynskaya	**−0.47**
CE	Zaporozhskaya	**−0.53**
C	Cherkasskaya	**−0.53**
C	Vinnickaya	**−0.55**
E	Luganskaya	**−0.63**
E	Doneckaya	**−0.63**
C	Kirovogradskaya	**−0.66**

Italics indicate that it separates different groups of regions by the value of marginal effect (indicates one separate group in the middle of the range).
Note: Coefficients in bold indicate significance at least at 10 per cent.

Table 4
Marginal effects from access to sewerage regression, 2004

Macroregion	Region	Marginal effects
C	Kievskaya	**−0.44**
S	Nikolaevskaya	**−0.47**
W	Rovenskaya	**−0.47**
CW	Zhitomirskaya	**−0.47**
S	Hersonskaya	**−0.48**
W	Ternopolskaya	**−0.50**
W	Volynskaya	**−0.50**
W	Lvovskaya	**−0.51**
W	Zakarpatskaya	**−0.52**
S	Crimea	**−0.53**
W	Hmelnickaya	**−0.54**
E	Poltavskaya	**−0.54**
S	Odesskaya	**−0.54**
W	Chernovickaya	**−0.54**
CE	Zaporozhskaya	**−0.55**
C	Vinnickaya	**−0.55**
C	Chernigovskaya	**−0.55**
W	Ivano-frankovskaya	**−0.56**
C	Cherkasskaya	**−0.56**
E	Sumskaya	**−0.56**
C	Kirovogradskaya	**−0.57**
E	Harkovskaya	**−0.57**
E	Luganskaya	**−0.58**
CE	Dnepropetrovskaya	**−0.60**
E	Doneckaya	**−0.64**

Note: Coefficients in bold indicate significance at least at 10 per cent.

Dnepropetrovskaya oblasts, where connection rates to sewerage are in the range of 50–60 per cent, but, as suggested by our analysis, could be improved further.

3. The affordability of utility payments

We now turn to the analysis of affordability. Gross affordability ratios are computed first, using estimates of total household expenditure in the denominator and the supposed monthly communal utility payments in the numerator. The ULMS asks how much households are required to pay on average for a set of utility services, including kvartplata (payments for the use of apartment), cold and hot water, metered gas, central heating, radio reception, electricity, cable television and telephone. Although the exact reference period is not specified, the affordability numbers refer to the late spring–early autumn period. Our gross affordability estimates are broadly consistent with those produced by the Ukrainian statistical office (see Table 5).

The "utility payment required" used to calculate gross affordability may be different from actual payments. In Ukraine, any household with a gross affordability ratio in excess of 20 per cent is eligible to receive a housing subsidy (see Vaughan, 1995 for a description). The ULMS data also contains information on the amount of subsidy received. Although incomplete, we can use these data to estimate net affordability–utility payments net of targeted government support. Another interesting variable is utility arrears, which shows how much households *actually* pay.

The comparison of the different affordability measures yields some interesting results (Table 6). Without subsidies, recipient households would have to spend 11 per cent of their income on utilities. With the subsidy, this fraction falls to 5 per cent, compared with 9 per cent for the sample as a whole. In other words, housing subsidies push recipients below the average level of gross affordability, and cut the affordability ratio by over 50 per

Please cite this article as: Fankhauser, S., et al., Utility payments in Ukraine: Affordability, subsidies and arrears. Energy Policy (2008), doi:10.1016/j.enpol.2008.06.031

Table 5
Gross affordability by decile (utility payments in per cent of total expenditure)

Deciles of per capita expenditure	Based on ULMS, 2004				Ukrainian statistical office, 2005
	Mean	Std. dev.	Median	N obs	Mean
First	14.5	11.4	11.8	599	8.4
Second	13.2	10.0	11.3	622	8.1
Third	11.2	8.5	8.8	622	7.8
Fourth	9.4	7.5	7.9	599	7.2
Fifth	8.6	6.7	7.0	615	7.1
Sixth	9.1	7.1	8.0	609	6.8
Seventh	8.5	5.7	8.1	569	6.7
Eighth	7.9	5.9	6.8	615	6.1
Ninth	7.5	5.6	6.1	580	5.8
Tenth	6.7	4.7	6.1	587	4.5

Note: Gross affordability ratios are weighted averages in the corresponding range.

Table 6
Gross and net affordability, ULMS 2004, per cent

	Mean	Std. dev	Median	N obs
Gross affordability for the full sample	9	8	7	6577
Net affordability	5	7	3	776
Gross affordability for the sample above	**11**	**10**	**8**	**776**
Affordability net of arrears	13	9	10	1040
Gross affordability for the sample above	**13**	**9**	**11**	**1040**
Affordability net of arrears and subsidies	7.5	11	5	96
Gross affordability for the sample above	**14**	**12**	**12**	**96**

cent. Non-payment reduces the median affordability ratio by 1 per cent point (from 11 to 10 per cent), but does not significantly change the mean. There are 96 households in the sample that have utility arrears and receive a housing subsidy at the same time.

As a next step we look at regional differences in gross affordability (Table 7). Regional variation in gross affordability is explained to a large extent by the differences in access rates. Highly connected regions such as Kiev city, Kievskaya and Dnepropetrovskaya oblasts in the Central Ukraine, Nikolaev and Herson regions in the South, Harkovskaya and Poltavskaya oblasts in the East, and Ternopolskaya and Lvovskaya oblasts in the West tend to have higher than average affordability rates. Regions with low connection rates such as Kirovogradskaya, Vinnickaya and Cherkasskaya oblasts in the Central part and Ivano-Frankovskaya in the West have low affordability ratios. Another group of regions is comprised of those with low connection rates and low per capita income. Affordability ratios in these regions (Chernigovskaya, Luganskaya, Zhitomirskaya oblasts in the Central and Eastern parts, Volynskaya and Zakarpatskaya oblasts in the West) are in the upper part of the regional distribution.

A large part of the variation may be explained by differences in the socio-economic conditions between oblasts. Table 8 presents the results of a regression that accounts for these effects. The regression includes control variables for settlement type, access rates, labour market status, the size of the household and per capita income (expenditure), as well as oblast dummies to capture residual regional effects.

Affordability ratios decrease with income, although with an increasing marginal effect. At the mean income per capita, an increase of 1000 UAH a year reduces gross affordability by 1.4 per cent. Larger households have lower affordability, which could be due to economies of scale within a household (e.g. lower fuel use for heating and cooking). Pensioners have lower affordability ratios, possibly because of their saving habit.

Table 7
Gross affordability ratio by region, 2004

Macroregion	Gross affordability by region, per cent				
	Region	Mean	Std. dev.	Median	N obs
CE	Dnepropetrovskaya	12.5	7.7	11.7	413
C	Chernigovskaya	11.1	10.4	8.4	193
CW	Zhitomirskaya	10.8	9.1	9.8	167
C	Kiev city	9.9	4.9	9.2	313
CE	Zaporozhskaya	9.6	9.2	7.2	260
C	Kievskaya	9.2	7.9	8.6	178
C	Vinnickaya	5.8	4.8	4.4	313
C	Cherkasskaya	5.7	5.5	4.0	212
C	Kirovogradskaya	3.6	4.5	2.4	201
E	Harkovskaya	11.3	8.9	9.6	511
E	Poltavskaya	10.8	7.1	9.2	230
E	Sumskaya	8.8	4.9	7.9	243
E	Luganskaya	8.5	7.4	6.1	395
E	Doneckaya	8.5	8.2	6.2	751
S	Nikolaevskaya	15.3	10.6	14.3	63
S	Hersonskaya	9.5	8.9	6.4	206
S	Crimea	8.0	6.0	6.2	271
S	Odesskaya	7.9	6.9	5.6	306
W	Ternopolskaya	12.2	6.5	10.1	153
W	Lvovskaya	11.1	7.4	6.1	289
W	Zakarpatskaya	10.8	10.1	9.8	124
W	Hmelnickaya	10.7	7.4	11.0	213
W	Chernovickaya	9.7	9.3	6.6	94
W	Volynskaya	9.7	8.4	7.3	128
W	Rovenskaya	6.9	4.9	6.3	152
W	Ivano-frankovskaya	6.0	5.1	4.4	198
	Overall	9.3	7.9	7.3	6577

Table 8
Estimation results from the gross affordability regression

Dependant variable	Coefficient (per cent)
Access rates	
Centralised gas	**3.3**
Sewerage	**1.1**
Cold water	**1.3**
Hot water	**1.9**
Central heating	**1.0**
Settelement type (relative to village)	
Town type settlement	**0.8**
Small town	1.1
Medium town	**2.0**
Large town	**3.3**
Capital city	**3.7**
Unemployed	0.2
Household size	**−1.3**
Pensioner	**−0.4**
Per capita expenditure per 1000 UAH	**−1.4**
Per capita expenditure squared per 1000 UAH	**2.2*E(−4)**
Constant (includes contribution of electricity)	**11.4**
Number of obs	6563
R^2	0.42

Note: Robust standard errors, clustered on the household. Coefficients in bold type significant at least at 10 per cent.

Of particular interest are the contributions of individual utilities to the affordability ratio. We find that connection to centralised gas has the highest impact on affordability, increasing the gross affordability ratio by 3.3 per cent. Other services have a less pronounced, but also significant impact. Although the contribution of the central heating connection appears rather low, this could be explained by the reference period of the survey, which is June–September 2004.

Please cite this article as: Fankhauser, S., et al., Utility payments in Ukraine: Affordability, subsidies and arrears. Energy Policy (2008), doi:10.1016/j.enpol.2008.06.031

Table 9
Subsidy probit regression

Specification 1: eligibility dummy			Specification 2: gross affordability		
Probability to get subsidy	0.099		Probability to get subsidy	0.101	
	dy/dx	Mean		dy/dx	Mean
Eligibility dummy	0.00	0.18	Gross affordability	**0.16**	0.09
Town type settlement	−0.01	0.14	Town type settlement	−0.02	0.14
Small town	0.02	0.02	Small town	0.00	0.02
Medium town	**0.05**	0.13	Medium town	**0.05**	0.13
Large town	**0.05**	0.23	Large town	**0.09**	0.22
Capital city	0.04	0.21	Capital city	0.06	0.21
Gender	**0.02**	1.77	Gender	**0.50**	1.78
Age	**0.002**	46.79	Age	**1.00**	46.81
HH size	−0.01	3.41	HH size	−0.11	3.38
Unemployed	0.01	1.87	Unemployed	0.32	1.87
Dirty fuel subsidy	**0.18**	0.04	Dirty fuel subsidy	**0.06**	0.03
Transport subsidy	−**0.11**	1.91	Transport subsidy	−**2.03**	1.90

Note: Coefficients in bold type significant at least at 10 per cent. Robust standard errors clustered on HH; dy/dx denotes a discreet change in specification 1.

The regional coefficients from the regression are not reproduced for space reasons, but they follow to a great extent regional distribution of the gross affordability ratios presented above. Overall, Western Ukraine appears to have higher affordability ratios, controlling for other characteristics. Western regions with officially low-income per capita (Zakarpatskaya, Ternopolskaya, Volynskaya) have the highest affordability ratios.

3.1. Subsidy targeting

Next we move to the issue of subsidy targeting. As mentioned above, most households with a gross affordability ratio of more than 20 per cent are eligible for a housing subsidy. In our sample, 12 per cent of the households are subsidy recipients.

Based on the gross affordability ratios computed in this paper, we analyse the effectiveness of subsidy targeting. To do so we introduce a subsidy eligibility indicator, which is a dummy variable equal to one if a household's gross affordability ratio is greater than 20 per cent. Efficient targeting would imply that the probability of getting a subsidy should be explained by this indicator alone.

However, the eligibility dummy is insignificant in a probit regression that also includes regional and settlement dummies, age and gender of the first respondent, labour market status, the size of the household and the receipt of other subsidies (such as dirty fuel and transportation subsidies) (see Table 9).

We are more successful if we replace the eligibility dummy by the gross affordability ratio variable itself, which turns out to be significant and positive. The corresponding elasticity indicates that a doubling of the gross affordability ratio (from its mean of 9 per cent) would lead to 16 per cent increase in the probability of getting a subsidy (Table 9). This suggests a rough but imperfect link between affordability and the receipt of housing subsidies.

Our results indicate that age strongly and positively affects the probability of getting a subsidy, which coincides with the finding that almost a half of subsidy recipients are pensioner households. Families in medium-sized and large towns are 5 per cent more likely (as compared to villages) to receive a subsidy, while small towns and town-type settlements do not differ from villages in this respect.

Households in receipt of transport and dirty fuel subsidies are also significantly more likely to obtain housing subsidies. This suggests that existing social support systems may be used to channel the subsidy. As for regional influences, households in Volynskaya oblast are 20 per cent more likely to get a subsidy, while residents of Zakarpatye region are 10 per cent less likely to do so.

Table 10
Subsidy targeting

	Subsidy recipient (per cent)		Total
	No	Yes	
Eligibility (per cent)			
No	**72.1**	9.9	81.9
Yes	15.8	**2.3**	18.1
Total	87.8	12.2	100.0

A different way to analyse subsidy targeting is to cross-tabulate households in receipt of a subsidy against those eligible to receive it, based on our gross affordability data (Table 10). This analysis again suggests that the targeting of housing subsidies is not effective. Only one in eight eligible households (2.3 per cent out of 18.1 per cent) actually receive the subsidy, and four fifth of the recipients (9.9 per cent out of 12.2 per cent) are supported erroneously. This is consistent with Clarke, 1997, where housing subsidy targeting in Ukraine is described as "haphazard" and "the administration of the benefit system" as "complex, bureaucratic and humiliating" leading to "low take-up" of such benefits by the eligible households.

4. Understanding arrears

Two indicators of non-payment are considered: the stock of arrears (in months) at the time of the survey (June–September 2004) and the change in arrears (also in months) between June–September 2004 and April–June 2003. A negative arrears flow indicates repayment.

Tables 11 and 12 present the regional distribution of the flow and the stock of arrears. Regions with high repayment rates (negative arrear flow) tend not to accumulate further arrears at the same time, and vice versa, with the exception of the Kiev city, which has both a high stock of arrears and considerable repayment.

Regions with high repayment rates are concentrated for the most part in the Western and Southern parts. Chernovickaya oblast (*W*) leads in terms of repayment, with 78 per cent of

Please cite this article as: Fankhauser, S., et al., Utility payments in Ukraine: Affordability, subsidies and arrears. Energy Policy (2008), doi:10.1016/j.enpol.2008.06.031

Table 11
The flow of arrears by regions, per cent, 2004

Macroregion	Arrears flow in months, 2004, per cent, weighted											
	Region	Repayment	0–1	1–3	3–6	6–12	12–18	18–24	>24	Mean	SE	Median	N obs
C	Kiev city	37	7	16	3	14	2	0	20	5.27	2.96	2.00	39
C	Kievskaya	27	24	10	10	27	0	0	3	0.52	2.75	1.22	14
C	Cherkasskaya	0	16	22	38	0	0	10	14	7.30	1.92	3.48	27
C	Kirovogradskaya	0	18	0	0	82	0	0	0	6.06	0.81	6.67	8
C	Chernigovskaya	0	0	43	11	21	25	0	0	7.10	1.17	4.62	26
C	Vinnickaya	0	33	15	17	11	24	0	0	5.96	1.17	2.00	34
CE	Dnepropetrovskaya	0	10	25	17	22	9	7	10	11.12	1.29	5.00	127
CE	Zaporozhskaya	0	2	7	20	36	19	2	15	11.45	1.28	8.33	54
CW	Zhitomirskaya	0	0	0	0	25	75	0	0	13.71	1.16	12.50	9
E	Poltavskaya	0	21	13	25	0	13	15	14	27.63	8.35	4.00	37
E	Sumskaya	0	0	80	10	0	10	0	0	3.57	0.80	2.27	21
E	Doneckaya	0	13	21	13	28	15	4	5	9.32	1.03	6.00	132
E	Harkovskaya	0	19	28	22	10	7	1	12	9.44	1.79	3.00	140
E	Luganskaya	0	15	11	23	27	10	6	8	11.28	1.82	5.26	94
S	Crimea	44	37	2	5	4	2	0	5	1.94	1.58	0.30	70
S	Hersonskaya	39	9	36	2	7	0	0	7	2.41	2.07	0.82	29
S	Nikolaevskaya	34	0	19	17	24	6	0	0	2.50	1.00	3.00	22
S	Odesskaya	22	21	11	11	15	0	0	21	9.21	4.41	5.00	26
W	Chernovickaya	78	0	11	0	4	0	0	7	-1.02	3.91	-5.00	11
W	Rovenskaya	63	11	11	13	0	0	0	1	0.58	0.51	-0.50	27
W	Volynskaya	59	7	14	12	0	0	3	5	1.54	1.48	-0.29	22
W	Lvovskaya	26	23	14	23	9	4	0	0	2.81	0.70	2.50	45
W	Ternopolskaya	18	43	31	5	3	0	0	0	0.96	0.36	0.77	27
W	Ivano-frankovskaya	11	18	23	3	22	1	0	21	9.36	2.99	1.40	46
W	Hmelnickaya	1	23	37	13	8	0	19	0	5.19	1.12	2.50	34
W	Zakarpatskaya	0	19	32	1	48	0	0	0	4.38	0.71	2.50	24

Table 12
The stock of arrears by regions, per cent, 2004

Macroregion	Arrears stock in months, 2004, per cent, weighted										
	Region	0–1	1–3	3–6	6–12	12–18	18–24	>24	Mean	SE	Median	N obs
C	Kievskaya	35	21	5	20	9	4	6	13.2	8.2	2.67	27
C	Vinnickaya	31	18	16	11	23	0	0	5.8	1.1	5.00	35
C	Kirovogradskaya	18	0	0	82	0	0	0	6.1	0.8	6.67	8
C	Cherkasskaya	16	22	38	0	0	10	14	7.3	7.3	3.48	27
CE	Dnepropetrovskaya	10	25	17	22	9	7	10	11.1	1.3	5.33	127
C	Kiev city	7	41	2	10	14	6	21	12.3	1.6	6.92	85
CE	Zaporozhskaya	2	7	20	36	19	2	15	11.5	1.3	10.00	54
C	Chernigovskaya	0	43	11	21	25	0	0	7.1	1.2	5.00	26
CW	Zhitomirskaya	0	0	0	25	75	0	0	13.7	1.2	15.38	9
E	Poltavskaya	21	13	25	13	0	15	14	27.6	8.4	5.00	37
E	Harkovskaya	19	28	22	10	7	1	12	9.4	1.5	3.43	140
E	Luganskaya	15	11	23	27	10	6	8	11.3	1.8	6.67	94
E	Doneckaya	13	21	13	28	15	4	6	9.3	1.0	6.67	132
E	Sumskaya	0	80	10	10	0	0	0	3.6	0.8	2.00	21
S	Crimea	36	17	26	6	10	0	5	6.8	1.5	2.00	93
S	Odesskaya	14	20	21	20	0	0	25	12.6	2.6	6.00	39
S	Hersonskaya	14	48	18	11	0	0	9	6.6	1.8	2.00	42
S	Nikolaevskaya	0	24	30	31	15	0	0	5.7	0.8	4.17	28
W	Ternopolskaya	45	31	18	7	0	0	0	2.1	0.3	1.16	35
W	Lvovskaya	38	17	37	6	3	0	0	3.4	0.4	2.50	62
W	Hmelnickaya	30	35	11	7	17	0	0	4.7	1.0	2.50	37
W	Rovenskaya	21	38	37	4	0	0	1	3.0	0.3	3.00	33
W	Ivano-frankovskaya	20	25	5	16	6	0	28	12.6	2.4	4.08	65
W	Volynskaya	20	59	13	0	0	6	2	4.2	0.9	2.50	30
W	Chernovickaja	18	8	20	37	0	12	5	9.1	2.3	8.54	15
W	Zakarpatskaja	17	33	1	49	0	0	0	4.5	0.6	3.50	27

households in arrears paying off their debt, followed by Rovenskaya oblast (*W*) with 63 per cent and Volynskaya oblast (*W*) with 59 per cent.

Much of the repayment is driven by policy. Volynskaya oblast, for instance, is one of the poorest regions, but has low rates of arrears accumulation and high repayment rates. In 2001 the oblast introduced a number of measures to address utility arrears and increase customer consciousness. They included service suspensions and litigation for debts of more than 5000 UAH. The customers in arrears were also offered an option of debt restructuring (see MUNEE, 2002 for a detailed description of all measures).

Please cite this article as: Fankhauser, S., et al., Utility payments in Ukraine: Affordability, subsidies and arrears. Energy Policy (2008), doi:10.1016/j.enpol.2008.06.031

In Kiev city, another region with a high repayment rate, debtors received warnings and court action was initiated for arrears in excess of 2000 UAH. Some non-payers were disconnected. Similarly, in Lvov region litigation was initiated for debtors with arrears in excess of 3000 UAH. In many cases, court decisions were enforced via salary deductions. Informal explanatory activities aimed at increasing compliance were also introduced, such as street cleaners reminding tenants of the necessity to pay (see Kravchenko et al., 2002 for a broader discussion).

Areas that have accumulated a large stock of arrears in 2004 are mostly industrialised regions in the Central and Eastern Ukraine, such as Kiev city (with 41 per cent of households having arrears in excess of 12 months), Vinnickaya (23 per cent), Doneckaya (25 per cent), Zaporozhskaya (36 per cent), Luganskaya (24 per cent), Poltavskaya (42 per cent), Cherkasskaya (24 per cent) and Chernigovskaya (25 per cent) oblasts, and one industrialised region in the West: Hmelnickaya oblast (19 per cent). Except for Kiev city, none of them have repayment flows.

We now turn to the statistical analysis of the data. Three different left-hand variables are considered: the existence (or probability) of utility arrears, the stock of arrears and the change in arrears between the two round of the ULMS survey. In all three cases arrears are modelled as a function of wage arrears, housing subsidy, connection rates, per capita expenditure and per capita expenditure squared, region, settelement type, age and gender of the first respondent and household size.

In addition to probit and OLS, we use instrumental variables in some specifications, instrumenting housing subsidy by the dirty fuel subsidy and transportation subsidy. Access rates are instrumented by the ownership of the dwelling and an interaction of the ownership variable and a dummy if a dwelling is a separate house, as was done with access rates. The validity of the instruments is confirmed by the Hansen *J*-statistic and the Anderson Likelihood Ratio statistic. (In the stock of arrears equation, instruments perform better than in the flow of arrears regression, as indicated by the Anderson LR statistic.)

4.1. Existence of arrears

The probability of non-payment is negatively correlated with access to centralised gas, while access to sewerage affects non-payment positively. The negative correlation in the former case suggests a disciplined policy of disconnection in the case of gas, something that may be more difficult to do in the case of water and sewerage. Receipt of a subsidy is negatively correlated with arrears, but the significance is weak.

Per capita expenditure and wage arrears are significant in some specifications but not in others. In particular, in the non-instrumented probit non-payment is positively related to wage arrears and negatively related to expenditure, but with a positive marginal effect (there are rich non-payers). Larger households have a higher probability of non-payment, although the effect is not always significant.

Non-payment is significantly higher than in Kiev city in Kievskaya, Dnepropetrovskaya, Ivano-Frankovskaya, Lvovskaya, Poltavskaya, Ternopolskaya, Harkovskaya and Chernovickaya oblasts, which are (except Ivano-Frankovskaya and Chernovickaya oblasts) areas with high connection rates. For some specifications Crimea and Volynskaya oblast are added to this list. Non-payment is lower in Vinnickaya, Kirovogradskaya and Cherkasskaya oblasts, where most arrears are short-term, and in Doneckaya oblast.

The probability to have arrears is higher in cities, medium-sized and large towns relative to villages. This could be because these settlements have more residential flats which are more difficult to disconnect than separate houses.

4.2. Stock of arrears

Both OLS and IV estimations give similar results. The stock of arrears is negatively and significantly correlated with the presence of wage arrears, which is in line with the fact that wage and pension arrears can be cancelled out with utility arrears by law. Instrumental variables estimation shows that Vinnickaya, Kirovogradskaya, Rovenskaya and Hersonskaya oblasts are significantly below Kiev city in terms of accumulation of arrears, controlling for other socio-economic characteristics. The results of the OLS estimation add four more oblasts: Rovenskaya, Sumskaya, Chernigovskaya and Ternopolskaya to the regions with the stock of arrears significantly below that in the Kiev city.

Per capita expenditure, which we use as a proxy for income, exhibits a U-shaped pattern, implying that the stock of arrears is decreasing in per capita expenditure, but that there is a substantial group of well-off non-payers. In fact, utility providers in Vinnitsa, Dnepropetrovsk and Makiivka (Donetsk oblast) explicitly targeted senior officials (Rada deputies, city executive committee officials, representatives of state administrations, prosecutor's office employees) and business leaders in their drive to increase payment discipline. This finding also agrees with MUNEE (2002), which reports two groups of non-payers in Volynskaya oblast: "low-income households who could not afford to pay the entire bill" and "deliberate non-payers, often well-to-do and well informed in legal matters". Coefficients on other independent variables, such as connection rates to centralised gas and sewerage, are not statistically significant.

4.3. Flow of arrears

Instrumental variables estimation suggests that Dnepropetrovskaya and Zaporozhskaya oblasts exhibit higher accumulation of arrears compared to Kiev city, while other regional dummies are not significant. Conclusions from the OLS estimation are similar, with an additional result of small towns having higher repayment than villages, and wage arrears being negatively correlated with utility arrears accumulation.

Whether the receipt of the housing subsidy affects accumulation of arrears could be of particular interest to policy-makers. Our estimation shows that for both stock and flow of arrears, the receipt of a subsidy is negatively correlated with the dependent variable (i.e., families in receipt of a subsidy tend to accumulate less arrears, as that could affect their eligibility for the subsidy), but it is not significant at conventional levels.

5. Conclusion

This paper analyses the effect of different socio-economic and regional indicators on the access to, the affordability of and non-payment for communal utility services—electricity, heat and water—in Ukraine, using uses panel household- and individual-level data from the Ukrainian Longitudinal Monitoring Survey for 2003–2004. We are especially interested in the variation in these indicators across 26 Ukrainian oblasts (regions) and four macro-regions.

Our main findings are four-fold (see also World Bank, 2005; Norets, 2002). First, access rates to utility services are universally high. This is a distinguishing feature of most post-Soviet

Please cite this article as: Fankhauser, S., et al., Utility payments in Ukraine: Affordability, subsidies and arrears. Energy Policy (2008), doi:10.1016/j.enpol.2008.06.031

economies and is in contrast to developing countries, where access to basic services is a key development challenge. In Ukraine, energy and water poverty is primarily a question of affordability, not access. However, in the face of rising costs, the preservation of high connection rates remains a main aim of social policy.

Second, gross affordability—the share of utility bills in total household expenditures before social support—is below the target 20 per cent level for a majority of households. However, this may change in the future (see also Dodonov et al., 2004). Tariffs have already gone up and will have to raise further to make the underfunded networks financially viable and finance rehabilitation needs (Evans, 2006 provides a comprehensive review of utilities' pricing and tariff reform issues).

Third, the social safety provisions to protect low-income consumer from further price increases are inefficient in reaching the target population. The current housing subsidy, aimed at households spending more than 20 per cent on utility services, reaches a fair share of non-eligible households, while under-supporting eligible ones. Only one in eight eligible households in the survey actually receive the subsidy, while four fifth of the recipients are supported in error.

Fourth, the incidence of utility arrears varies significantly by region. In the mostly poor Western Ukrainian and heavily industrialised Eastern Ukrainian regions we observe an accumulation of arrears. In Kiev city and areas with strictly enforced collection past arrears are now being repaid. This points toward growing differences in energy and water poverty within the country.

Our results underline the policy challenges of utility reform in Ukraine. Tariff reform, which is clearly needed, has to be complemented by improvements in social policy, better targeting and a strengthening of state institutions. Research also has a role to play. While weak institutions are a key constraint, insufficient information about consumption patterns, access and affordability is another important factor that limits effective social support.

Acknowledgements

In writing this paper we have benefited from the comments of Elcin Akcura, Randolph Bruno and Alexander Muravyev. The background research for this paper was funded by the UK Department for International Development. This funding is gratefully acknowledged. The paper was written while all three authors were at EBRD.

Appendix A. The map of Ukraine (Source: http://www.geocities.com/CapeCanaveral/Launchpad/4664/ukrmap.gif)

References

Clarke, S., 1997. Poverty in Ukraine. Available online at 〈www.warwick.ac.uk/fac/soc/complabstuds/russia/Poverty_Ukraine.doc〉.

Dodonov, B., Opitz, P., Pfaffenberger, W., 2004. How much do electricity tariff increases in Ukraine hurt the poor? Energy Policy 32 (7), 855–863.

Evans, M., 2006. Energy prices, tariffs, taxes and subsidies in Ukraine. In: Energy Prices & Taxes, 4th Quarter 2006. Available online at 〈http://data.iea.org/ieastore/assets/products/eptnotes/feature/FTR06Q4A.pdf〉.

Fankhauser, S., Tepic, S., 2007. Can poor consumers pay for energy and water? An affordability analysis for transition countries. Energy Policy 35 (2), 1038–1049.

Foster, V., Tiongson, E.R., Ruggeri Laderchi, C., 2005. Utility reforms. In: Coudouel, A., Paternostro, S. (Eds.), Analyzing the Distributional Impact of Reforms, vol. 1.

Please cite this article as: Fankhauser, S., et al., Utility payments in Ukraine: Affordability, subsidies and arrears. Energy Policy (2008), doi:10.1016/j.enpol.2008.06.031

World Bank, Washington, DC Available online at 〈http://siteresources.worldbank.org/INTPSIA/Resources/490023-1120845825946/Utility.pdf〉 (Chapter 3).
IPA Energy, 2003. Can the poor pay for power? The affordability of electricity in South-east Europe. Available online at 〈http://www.ebrd.com/country/sector/energyef/about/powersee.pdfwww.ebrd.com/country/sector/energyef/about/powersee.pdf〉.
Kennedy, D., 2005. Lifelines in Europe and Central Asia. Infrastructure transition in Europe and Central Asia, Refocusing the Infrastructure Transition Agenda. Draft, World Bank, Washington, DC.
Kravchenko, N., Levitsky, A., Sviatotska, V., 2002. Payment Collection for Housing and Communal Services: The Experience of Ukrainian Cities. PADCO International, Kiev, Ukraine.
Lampieti, J., Meyer, A., 2002. Coping with the cold, heating strategies for Eastern Europe and Central Asia's urban poor. World Bank Technical Paper No. 529, Washington, DC.
Lampieti, J., Kolb, A., Gulyani, S., Avenesyan, V., 2001. Utility pricing and the poor, lessons from Armenia. World Bank Technical Paper No. 497, Washington, DC.
Lovei, L., Gurenko, E., Haney, M., O'Keefe, P., Shkaratan, M., 2000. Maintaining Utility Services for the Poor, Policies and Practices in Central and Eastern Europe and the Former Soviet Union. World Bank, Washington, DC.
Municipal Network for Energy Efficiency (MUNEE), 2002. Lutsk: A Case Study of Ukraine's Municipal Energy Efficiency Best Practice. Available online at 〈http://www.munee.org/node/124〉.
Norets, A., 2002. Household Arrears in Ukraine: Microeconometric Evidence. Master's Thesis, Kiev-Mohyla Academy University, Ukraine.
OECD, 2003. Social Issues in the Provision and Pricing of Water Services. OECD, Paris.
OECD, 2005. Water Supply and Sanitation Sector Reform: Financing Water Services and the Social Implications on Tariff Reform. June.
Vaughan, R.J., 1995. A History and Overview of Ukraine's Housing Subsidy Program. PADCO International, Kiev, Ukraine.
Velody, M., Cain, M., Philips, M., 2003. A regional review of social safety net approaches in support of energy sector reform. Mimeo, USAID, October.
Wooldridge, J.M., 2002. Econometric Analysis of Cross Section and Panel Data. The MIT Press, Cambridge, MA.
World Bank, 2005. Ukraine: Poverty Assessment. Poverty and Inequality in a Growing Economy. December, Washington, DC.

Please cite this article as: Fankhauser, S., et al., Utility payments in Ukraine: Affordability, subsidies and arrears. Energy Policy (2008), doi:10.1016/j.enpol.2008.06.031